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AEGIRITE AND RIEBECKITE ROCKS FROM OKLAHOMA

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Several years ago the writer spent a short time in studying and collecting the igneous rocks of the Headquarters Mountains in Oklahoma. An examination of the rocks some time afterward revealed the presence of aegirite and riebeckite, minerals which at the present time can scarcely be called rare, but are very interesting. Other occurrences of riebeckite in this country are: (1) granite of Quincy, Mass.;¹ (2) pegmatite of St. Peter's Dome, Colorado;² (3) paisanite, Paisano Pass, Texas.³

The Headquarters Mountain group comprises several low mountains at the extreme western border of the Wichita Range. The largest lies adjacent to and northwest of the town of Granite, Greer County, Oklahoma. There are several further to the northwest and a single one a little southeast of the town, all being west of the North Fork of the Red River.⁴ These mountains like the others of the Wichita Range to the east rise abruptly from the level plain which give them an archipelago character.

THE COUNTRY ROCK

The main mass of these mountains is made up of a coarse-grained red granite. It weathers to large, rounded boulders. Fresh specimens are very difficult to obtain as the ferro-magnesian constituents are almost invariably altered. The average size of the constituent minerals is about 7^{mm}. Under the microscope the rock is seen to be made up of orthoclase, albite, quartz, amphibole and zircon. The

¹ Washington, *Am. Jour. Sci.*, Vol. VI (1889), p. 180.

² Lacroix, *C. R.*, Vol. CIX (1889).

³ Osann, *T. M. P. M.*, Vol. XV (1896), p. 437.

⁴ For location see map, Plate II (opposite p. 54), "Professional Paper No. 31." *U. S. Geol. Surv.* On p. 58 of this paper a paragraph is given to description of this group of mountains. They are said to consist of red granite similar to that of the Wichita group.

orthoclase is intergrown with albite with characteristic twin lamellae appearing around the border or in the interior, thus forming microperthite, which is a characteristic feature of the rocks of this locality. An occasional Carlsbad twin occurs. The quartz is full of very minute inclusions. The amphibole is a dark-colored one with the following axial colors: **a**, brown, **b**, deep greenish-blue, **c**, deep bluish-green. The extinction angle on (110)¹ is about 25°. The elongation is parallel to slower ray. It has the 124° cleavage of amphibole. Doubtless it is a soda amphibole, perhaps nearer hastingsite than any described mineral. Several small zircon crystals were discovered in the fragments of the crushed rock. Biotite was also noticed in some of the rock.

GRANITE-PORPHYRY, MICRO-GRANITE, ETC.

About half of the number of rock varieties collected are included under this heading. They grade from coarse granites with porphyritic tendency to fine-grained micro-granites, and are usually reddish or reddish-gray in color.

These fine grained micro-granites weather into rather angular boulders.

The rocks are aggregates of quartz and orthoclase (often microperthite) with accessory amphibole, biotite, magnetite and apatite. The amphibole is sometimes riebeckite, sometimes one resembling that of the country rock. A rather peculiar intergrowth of quartz and orthoclase was noticed in one rock (No. 3). It may be described as an orthoclase mosaic in quartz. The quartz areas have uniform extinction over quite large areas, while the orthoclase areas only have uniform extinction over small areas. Thus it is neither a micropegmatitic nor micropoikilitic growth. One of the micro-granites occurs on the top of Mt. Walsh, the highest point of the Headquarters group. It is but a few feet thick and a little way down the slope the contact between it and the coarse granite may be seen.

APLITE VEINS

Perhaps the most interesting rocks of the region are the narrow dikes that cut the coarse granite, the country rock. About seven or

¹ Determined on cleavage flakes.

eight of these occur near the center of the largest mountain just northwest of Granite. They vary in width from one to sixteen inches. The prevailing color is a greenish-gray inclined to reddish-gray in places. The rocks are fine-grained with equidimensional constituents averaging about 1^{mm} in diameter. With a lens glassy grains of quartz, cleavable feldspars, black prismatic crystals (riebeckite), usually small but sometimes 3^{mm} in length, and minute greenish patches and needles (aegirite) can be recognized.

In thin sections these rocks are seen to be fine-grained mosaics of quartz, microperthite, and accessories with the typical panautomorphic texture of aplites. Both the feldspar and quartz have a tendency to assume a crystal form. The microperthite is an intergrowth of cloudy orthoclase with clear albite which is recognized by extinction angles and index of refraction. The albite occurs in patches within the orthoclase, on its border and in a few cases, independently. The orthoclase often occurs in Carlsbad twins. The quartz is xenomorphic to automorphic in various specimens. The best automorphic quartzes were hexagonal in outline though only a few of these were basal sections. The riebeckite, one of the accessory minerals usually occurs in large patchy aggregates so characteristic for this mineral, but in one rock (No. 12) it was in the form of small grains. Its color varies from green through a bluish-green and greenish-blue to deep, almost opaque blue. The axial colors are **a**, very deep blue; **b**, deep blue; **c**, green. $\mathbf{a} > \mathbf{b} > \mathbf{c}$. The extinction is practically parallel. In addition to cleavage parallel to (110), parting parallel to (010) was noticed. The aegirite varies from minute needles to small prismatic crystals with the octagonal cross-section characteristic of the pyroxenes. The pleochroism is yellowish-green to emerald-green, and the maximum extinction 5 or 6°. Magnetite and microcline are found in small amount.

The order of consolidation seems to have been first, the orthoclase, then the albite, next the aegirite and finally the quartz. The aegirite occurs as inclusions in the quartz (but not in the orthoclase), but mostly between the quartz and orthoclase. In one rock (No. 44) aegirite needles occur with their long axes parallel to outlines of the quartz. In this case it looks as though the quartz had simply pushed aside the aegirite, as there is no constant orientation due to

crystallization. Apparently the more abundant the aegirite is, the more abundant the albite.

An interesting case of alteration was found in one of the veins. Specimens of a vein some distance apart were collected before they were discovered to be the same rock. One of these (No. 44) was a fresh rock, greenish-gray color, with abundant crystals and needles of aegirite. The other specimen (No. 23) was gray with a dead look. The aegirite had disappeared and abundant magnetite had formed at its expense. The outlines of the aegirite crystals were filled with magnetite dust, and there were many large magnetite grains and crystals all through the rock.

RIEBECKITE PEGMATITE

At the foot of Main Street, in the town of Granite, near the base of the mountain, a pegmatite vein six and one-half inches (16^{cm}) wide was found. It occurs in the coarse granite and has a nearly east-west strike with dip toward the north. The striking thing about this rock is the occurrence of prismatic crystals two or three centimeters long and $\frac{1}{2}$ ^{cm} in diameter. They have the six-sided cross-section of the amphiboles, and often appear with a central core of orthoclase. The other minerals are quartz, orthoclase and a little albite. The rock has the typical vein structure, for at the center is a band of fine-grained rock, on either side a zone of coarse-grained rock, and then on each side at the contact with the wall rock there is a band of fine-grained rock. Each of the bands is about 3^{cm} wide, but the vein is not quite symmetrical.

DIABASE DIKE

A short distance east by northeast of Mt. Walsh a fine-grained, black, basic dike, about four and one-half feet wide occurs. It has an east-west strike and almost vertical dip. The rock is exposed in a prospect shaft and is much altered. It consists of lath-shaped plagioclases, amygdules filled with a chlorite-like mineral (representing original ferro-magnesian mineral), and abundant magnetite. The rock has the typical ophitic structure, and so is a diabase.

An interesting thing about this dike is that it can be traced across the mountain by the character of the vegetation, though the rock is only exposed in one spot. The vegetation on the mountain is very

scant, but along the "lead" of this dike the vegetation is very abundant and a narrow strip of shrubs extends across the mountain.

These rocks are mostly soda rich as shown by the presence and comparative abundance of microperthite (orthoclase-albite), aegirite, riebeckite, and another soda amphibole of doubtful identity. A study of these rocks in connection with those of other parts of the Wichita mountain system, especially if chemical analyses were available, would probably give some very interesting results.